Deep Generative Modelling: A Comparative Review of VAEs, GANs, Normalizing Flows, Energy-Based and Autoregressive Models

Abstract

Deep generative models are a class of techniques that train deep neural networks to model the distribution of training samples. Research has fragmented into various interconnected approaches, each of which make trade-offs including run-time, diversity, and architectural restrictions. In particular, this compendium covers energy-based models, variational autoencoders, generative adversarial networks, autoregressive models, normalizing flows, in addition to numerous hybrid approaches. These techniques are compared and contrasted, explaining the premises behind each and how they are interrelated, while reviewing current state-of-the-art advances and implementations.